



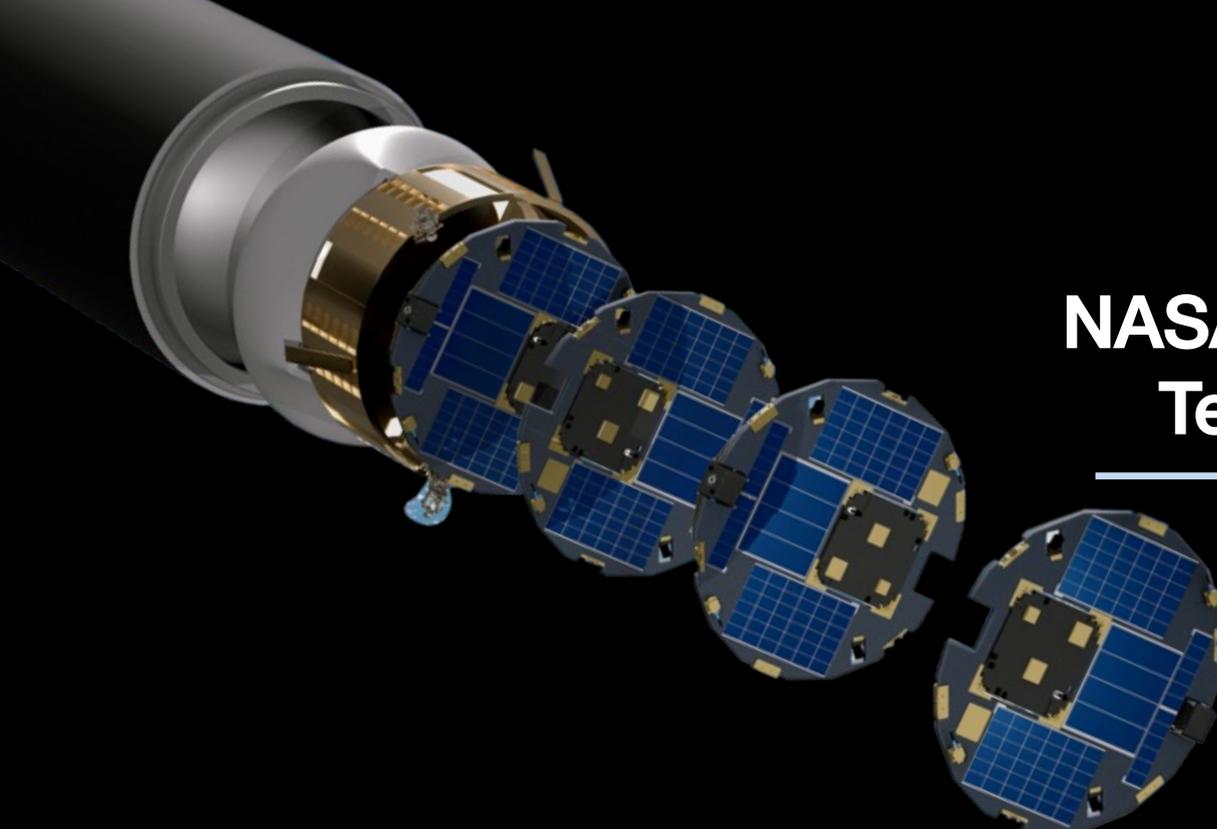
# NASA Small Spacecraft Technology Program

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**Roger C. Hunter**  
Program Manager

**Small Spacecraft Technology Program**

NASA Town Hall ♦ August 7, 2023  
Small Satellite Conference

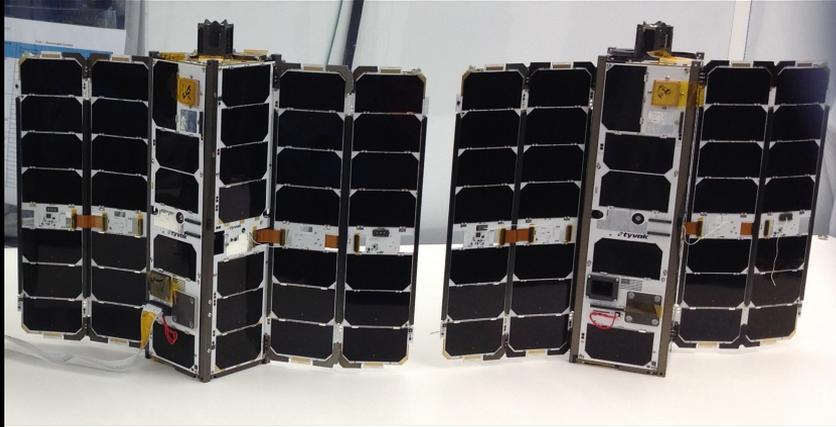


# 2023-2024 Launch Schedule



Technology Demonstrations	Launch Timeframe
<b>Starling:</b> <i>Demonstration of Autonomous Swarm Technologies</i>	Launched July 17, 2023
<b>R5 (S2 and S4):</b> <i>Rapid Technology Maturation</i>	NET 16 Oct 2023
<b>R5 (S3 and S5):</b> <i>Rapid Technology Maturation</i>	NET 1 Nov 2023
<b>PY4:</b> <i>Four CubeSat Swarm of PYPubed-Based Spacecraft</i>	NET 1 Jan 2024
<b>DUPLEX:</b> <i>Dual Propulsion Experiment</i>	1 Feb 2024
<b>ACS3:</b> <i>Advanced Composite Solar Sail System</i>	Q1 / CY2024
<b>PTD-4:</b> <i>Pathfinder Technology Demonstrator-4: Payload: LISA-T High-Power Deployable Solar Array Antenna</i>	NET Jun 2024
<b>PTD-R:</b> <i>Monolithic UV/SWIR/VIS Camera</i>	NET Jun 2024
<b>Courier:</b> <i>Solar Electric Propulsion Module</i>	Oct 2024
<b>DiskSat:</b> <i>Two-Dimensional, High-Power, High-Aperture Maneuverable Spacecraft</i>	Q4 / CY2024
<b>CLICK B/C:</b> <i>CubeSat Laser Infrared CrossLink</i>	NET Dec 2024

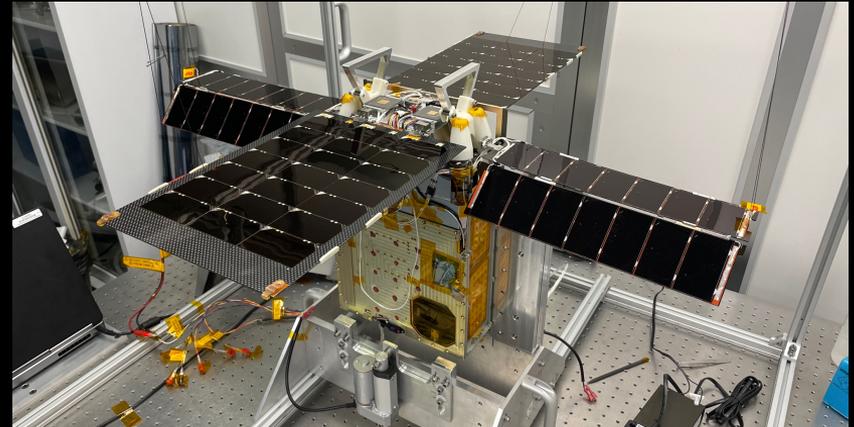
# Spacecraft at End of Mission in 2023



**CubeSat Proximity Operations  
Demonstration (CPOD)**  
**Launched: May 25, 2022**  
**End of Mission: June 30, 2023**

The mission was unable to demonstrate rendezvous, proximity operations and docking (RPOD) maneuvers as planned due to challenges with propulsion and GNC subsystems.

*Image Credits: Terran Orbital Corporation*

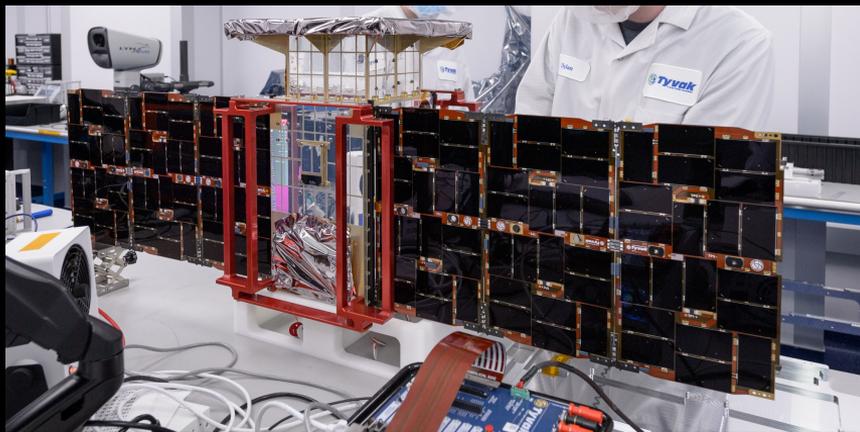


**Lunar Flashlight**  
**Launched : December 11, 2022**  
**End of Mission: May 11, 2023**

Spacecraft unable to generate enough thrust to complete maneuvers to stay in the Earth-Moon system to search for surface ice in the permanently shadowed craters of the South Pole.

*Image Credits: NASA/JPL-Caltech*

# On-Orbit U-Class Technology Demonstration Missions



## **CAPSTONE**

**Launched: June 28, 2022**

**Status: Ongoing**

Demonstrate ability to enter and maintain a near rectilinear halo orbit around the Moon. Demonstrate one & two way ranging and autonomous spacecraft navigation

*Spacecraft Image Credits: NASA;*



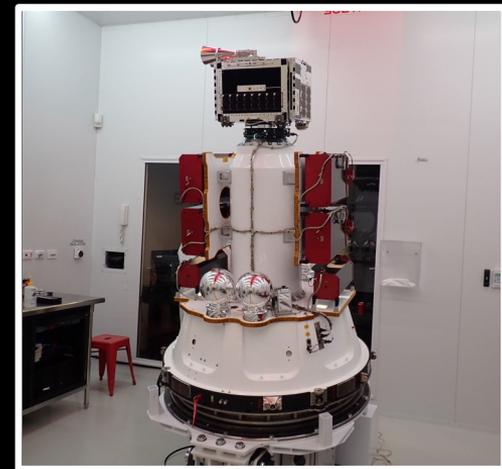
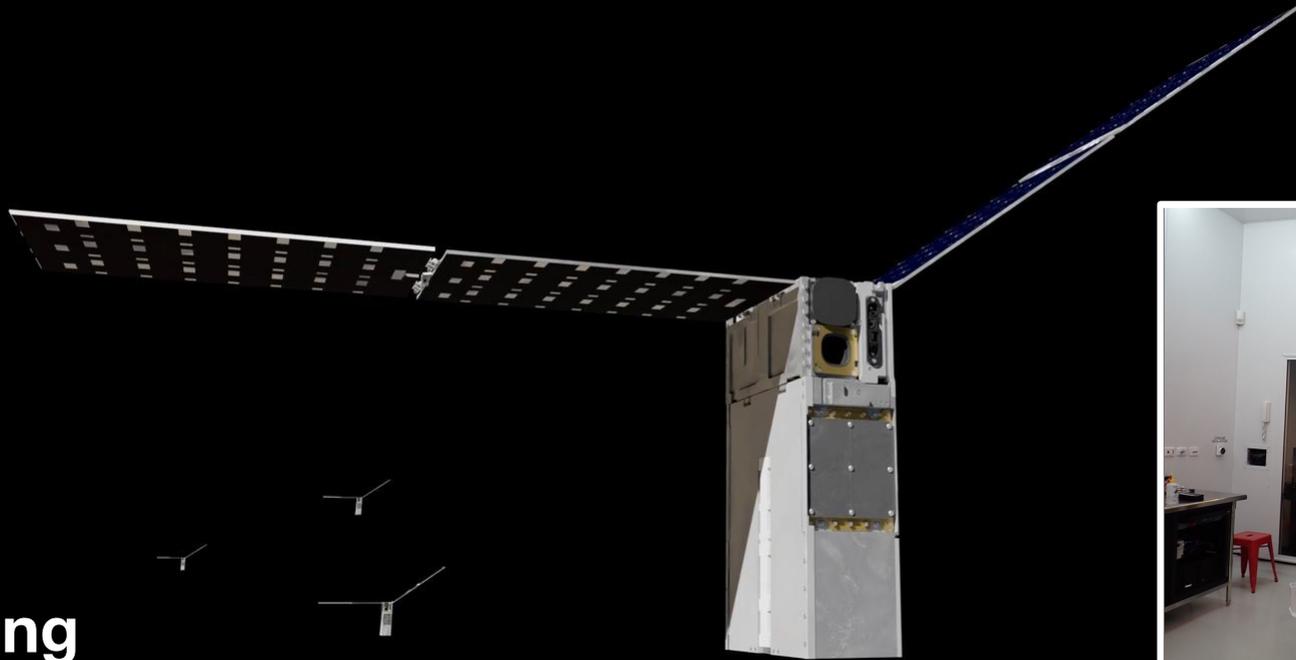
## **Pathfinder Technology Demonstrator (PTD-3)**

**Launched: May 25, 2022**

**Status: Ongoing**

Demonstrate TeraByte InfraRed Delivery (TBIRD) technology for high-bandwidth laser communications. Demonstrated 200 gigabit per second data downlink rate on April 28.

*Animation Credits: NASA*



# Starling

Starling's four 6U CubeSats launched on July 17, 2023 from Rocket Lab Launch Complex 1 in Mahia, New Zealand. Starling will test swarm maneuver planning and execution, communications networking, relative navigation, and autonomous coordination between spacecraft. Animated Image Credits: NASA. Image Credits: Rocket Lab

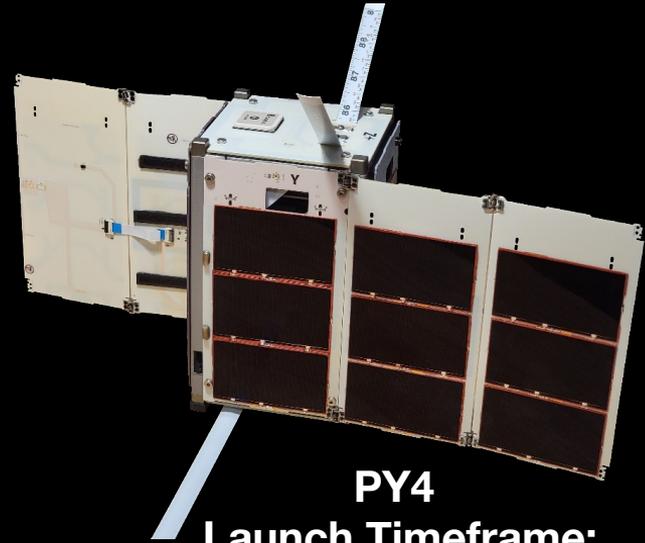
# Upcoming U-Class Technology Demonstration Missions – 2023-2024



**R5**  
**Launch Timeframe:**  
**NET October 16, 2023**

Build and operate rapid, low-cost, highly-capable spacecraft platforms to demonstrate payloads of interest and technology relevant to human spaceflight .

*Image Credits: NASA*

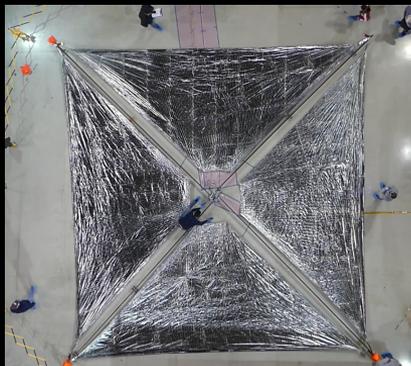


**PY4**  
**Launch Timeframe:**  
**NET January 1, 2024**

Demonstrate low size, weight, power, and cost (SWaP-C) spacecraft-to-spacecraft ranging, on-orbit relative navigation, and coordinated simultaneous multi-point radiation measurements

*Image Credits: Max Holliday, NASA Ames*

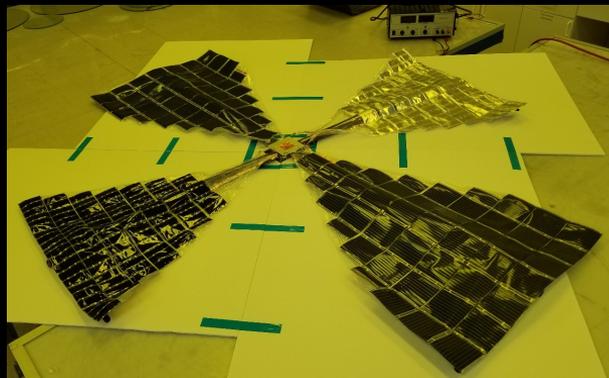
# Upcoming U-Class Technology Demonstration Missions – 2024



**Advanced Composite Solar Sail System (ACS3)**  
**Launch Timeframe:**  
**Q1 CY2024**

Demonstrate deployment of the composite boom solar sail in low-Earth orbit. The unfurled solar sail will measure approximately 84 m<sup>2</sup>

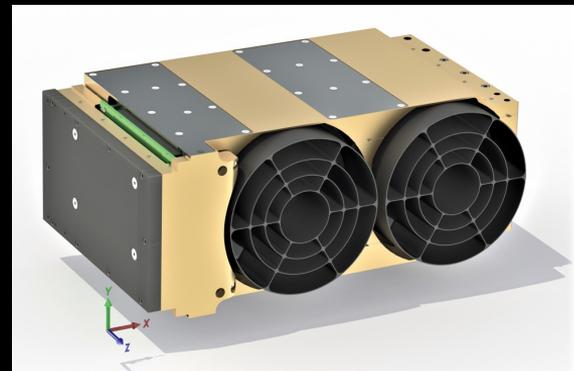
*Image Credits: NASA*



**Pathfinder Technology Demonstrator (PTD-4)**  
**Launch Timeframe:**  
**NET June 2024**

Demonstrate Lightweight Integrated Solar Array and anTenna (LISA-T) – A high-power deployable solar array antenna

*Image Credits: NASA*

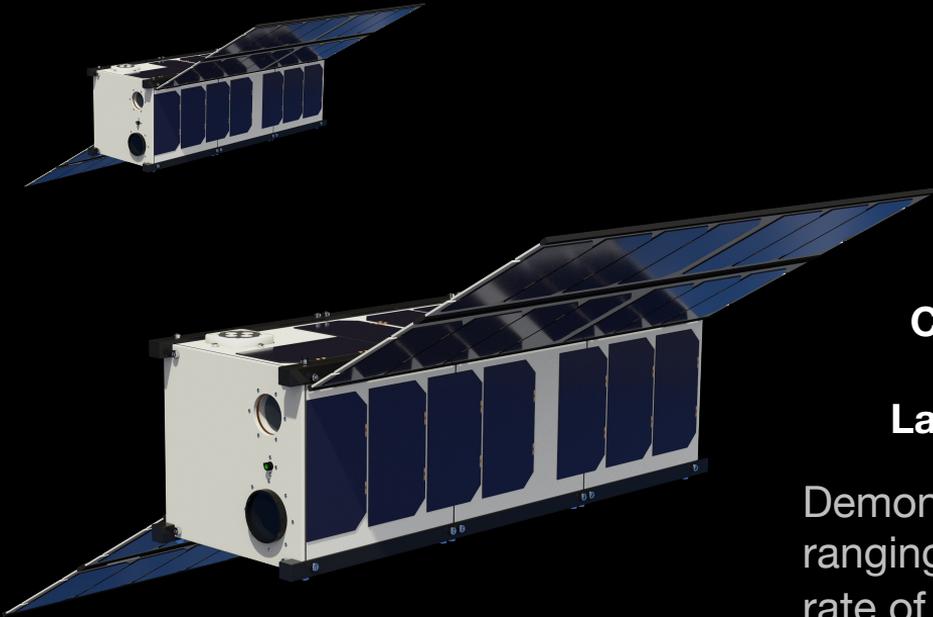


**Pathfinder Technology Demonstrator (PTD-R)**  
**Launch Timeframe:**  
**NET June 2024**

Demonstrate a new type of UV and SWIR Telescope that may be used in a wide range of applications.

*Image Credits: Lawrence Livermore National Laboratory*

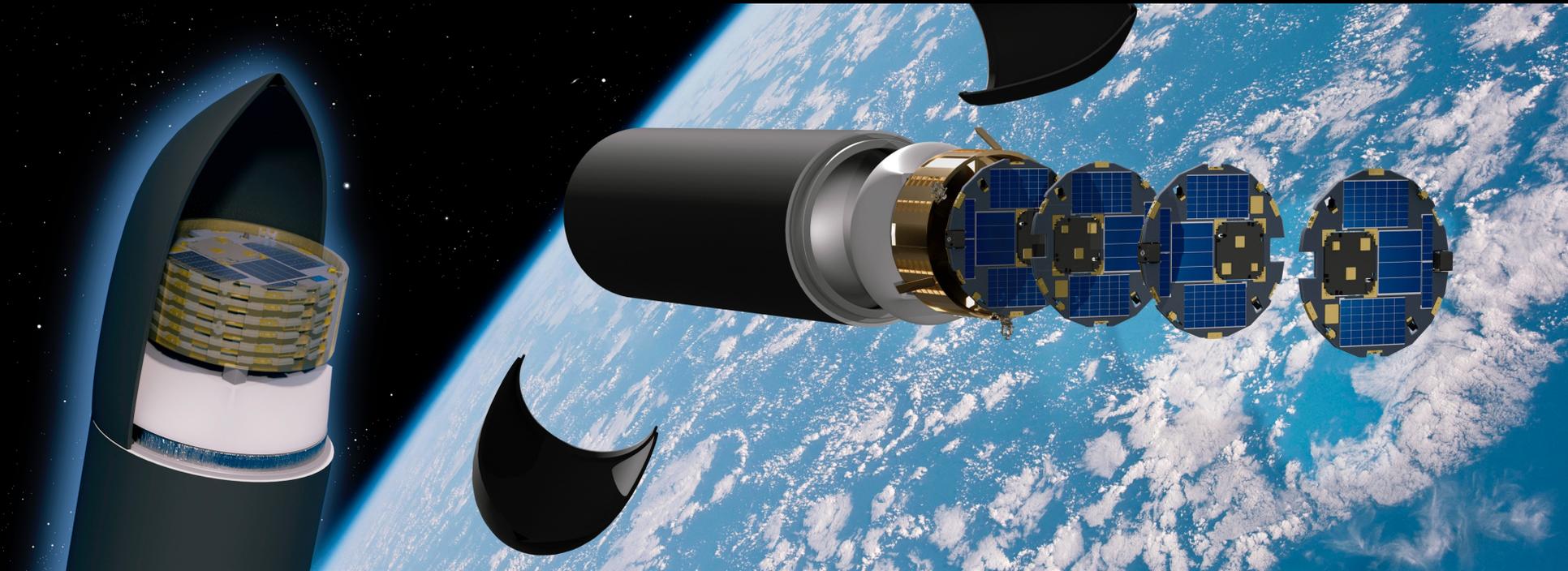
# Upcoming U-Class Technology Demonstration Missions - 2024



## **CubeSat Laser Infrared Crosslink (CLICK B/C) Launch Timeframe: December 2024**

Demonstrate optical crosslink and precision ranging between two 3U CubeSats at a data rate of 20 Mbps and range up to 580 km

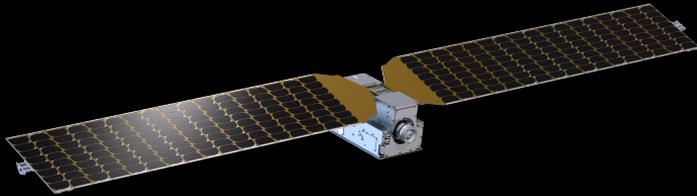
*Image Credits: NASA*



# DiskSat

DiskSats are high-power and high-aperture alternatives to CubeSats. They are launched in tight stacks but are deployed individually to ensure no recontact between satellites. This first DiskSat demonstration is anticipated to launch no earlier than the last quarter of CY2024. Image Credit: The Aerospace Corporation

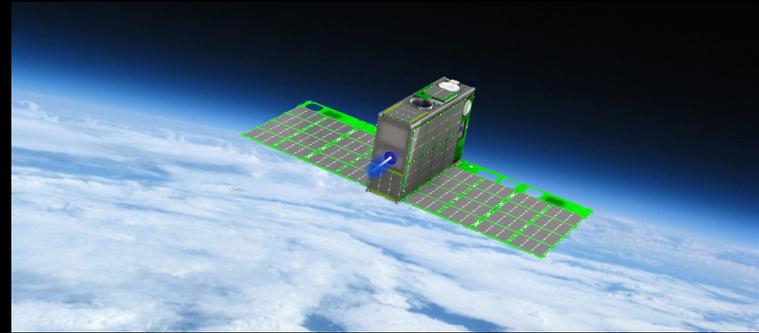
# Tipping Point Projects – 2019



The 12U Courier CubeSat contains a compact, high impulse solar electric propulsion module. The mission will demonstrate a Halo Hall Effect Thruster which operates between 85-175 W.

Launch Timeframe: Oct. 2024

Image Credits: ExoTerra Resource, LLC.



A 6U Dual Propulsion Experiment CubeSat. Both propulsion systems, the Fiber-fed Pulsed Plasma Thruster and Monofilament Vaporization Propulsion, were developed with NASA SBIR funding.

Launch Timeframe: Feb. 1, 2024

Image Credits: CU Aerospace, LLC.



# Announcement of Collaboration Opportunity Projects – 2018



Diagram of the concept of operations for the Cislunar Autonomous Positioning System (CAPS). CAPS is an innovative spacecraft-to-spacecraft navigation solution to be demonstrated on the CAPSTONE mission currently in orbit around the Moon. CAPS is anticipated to allow future spacecraft the ability to determine their location relative to the Moon without relying exclusively on tracking from Earth.  
Image Credits: Advanced Space, LLC

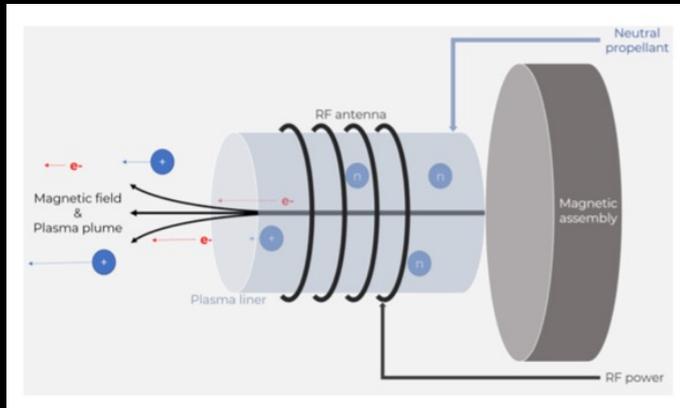
*A public-private partnership with NASA's Goddard Space Flight Center*



The Vulcan Wireless CubeSat radio, NSR-SDR-S/S. This CubeSat radio is a fully integrated, full-duplex, software-defined radio transponder. The radio transponder is being tested for compatibility with NASA's Space Network.  
Image Credits: Vulcan Wireless, Inc.

*A public-private partnership with NASA's Goddard Space Flight Center*

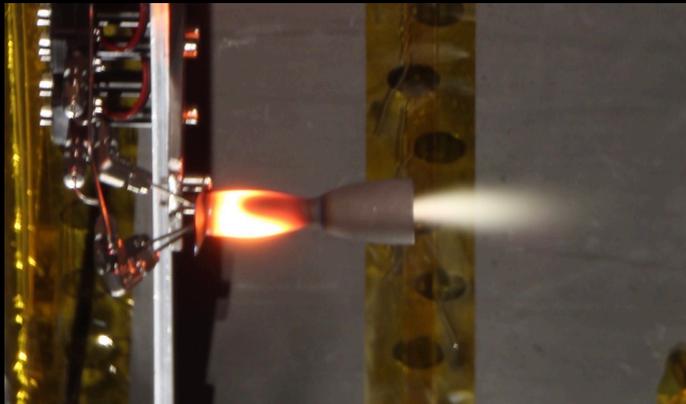
# Announcement of Collaboration Opportunity Projects - 2020



The Phase Four RF plasma thruster operates by using RF to heat propellant into ionized plasma that is then ejected away from a spacecraft by a permanent magnet, creating thrust.

Image Credits: Phase Four

*A public-private partnership with NASA's Glenn Research Center*



A prototype bipropellant thruster is shown in ambient pressure testing. The key technology being tested is the propellant pump - an enabling technology for launch safety approval (no stored gas) and system performance (lightweight tanks). Testing includes a propulsion system composed of monopropellant and bipropellant systems.

Image Credits: Stellar Exploration, Inc.

*A public-private partnership with NASA's Ames Research Center*



# THE OPEN NEWS

## Uncontrolled Invasion: NASA's Starling Mission Sending Multitude of Satellites into Space

Patil, Pooja. "Uncontrolled Invasion: NASA's Starling Mission Sending Multitude of Satellites into Space." *The Open News*, 18 July 2023, [www.opentheneews.com/uncontrolled-invasion-nasas-starling-mission-sending-multitude-of-satellites-into-space](http://www.opentheneews.com/uncontrolled-invasion-nasas-starling-mission-sending-multitude-of-satellites-into-space).